special advantages claimed for this paper is that the several difficulties involved in the working of ordinary papers are removed. The chief simplification is in the fact that a dark room may be entirely dispensed with, all operations being performed in an ordinary room lit in the usual manner. The paper is described as being coated with a chloro-bromide emulsion, and it is owing to the extreme slowness of this that a special non-actinic illumination is unnecessary. Of course, care is wanted, and *direct* light should not be allowed access to the print; but in an ordinary room, lit by two windows at middle of day, perfectly clean whites may be obtained by turning the back to the window, and developing in the shade thus produced.

Again, no great amount of apparatus is required, not even a printing frame; development is very efficiently performed on a sheet of glass, applying the developer with a pledget of cotton-wool or a mop camel-hair brush.

The exposure for contact printing from an average negative varies from 1-3 seconds for diffused daylight, to 30-120 seconds to a gas-burner at 6 inches distance. A point that might with advantage be added to the instructions for use, is the great convenience of magnesium ribbon as an illuminant. This is being brought forward by many leading plate and paper makers, and deservedly so. The light of burning magnesium is one of the most intense illuminants at present known; and as a great part of the light is concentrated in the blue and violet regions of the spectrum, the parts most effective on a silver emulsion, this gives the light a high efficiency. From 1-3 inches of ribbon, burnt at from 8-12 inches distance, will be found to give satisfactory exposures. Another point in favour of using magnesium is the ease of firing it, all the extra articles needed being a box of matches.

It might be worth while to make the gelatine, &c., which forms the basis of the emulsion, more insoluble than it appears to be from the samples tested, as many people find it convenient to dry prints quickly, and if the paper has not been specially treated, there is danger of blisters or of complete melting of the film. The paper is obtainable in several varieties of surface and suitability for different purposes.

Another suggestion, not mentioned in the circular issued, may perhaps be made as likely to extend its popularity. It is that the paper may be toned with any of the usual toning baths for bromide paper, the one made with copper sulphate and potassium ferricyanide, giving reddish-brown tones, being very suitable.

One of its good qualities is the ease of maintaining pure whites; and this will no doubt lead to its extensive use for copying purposes, as both the negative and positive may be made on the paper. For scientific workers, as well as pictorial photographers, the paper will doubtless prove a great boon.

From its extreme simplicity of manipulation, moderate price, and general high quality, the paper ranks high among silver emulsion printing papers.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. RICHARD ABEGG, privat-docent in physical chemistry at Göttingen, has been promoted to the rank of professor; Dr. Oswald Lohse, observer in the Potsdam Astrophysical Observatory, has also been promoted to a professorship; Dr. Böhmig, privat-docent in zoology at Gratz, has been appointed assistant professor; Prof. Kalkowsky, of the Technical High School in Dresden, has been appointed director of the geological and prehistoric museum there.

ON Wednesday in last week, the Duke of Devonshire opened the new Christie Library at the Owens College, Manchester, and laid the foundation of the Whitworth Hall, another addition to the college buildings. The library is the gift of Mr. R. C. Christie; and the expense of erecting the Whitworth Hall will be met by the sum of 50,000*l*. received by Mr. Christie as one of the residuary legatees of the estate of the late Sir Joseph Whitworth, and since paid by him to the Treasurer of Owens College.

IT is but rarely that an issue of *Science* appears without the announcement of one or more gifts to educational and scientific institutions in the United States, or for the advancement of learning. The following are among the donations recently announced:—By the will of the late Dr. Elizabeth H. Bates, of Port Chester, N.Y., the University of Michigan will receive 125,000 dollars, the income from which is to be used in establishing a chair for the diseases of women and children, to be known as the Bates professorship.—The will of the late Mrs. Annie S. Paton, of New York, leaves 100,000 dollars to Princeton University, subject to an interest for life of her two sons. The bequest is to found a fund for an endowment for Paton lectureships in ancient and modern literature.—It is said that Mrs. Phœbe Haarst will erect a building for mining engineering for the University of California at a cost of 300,000 dollars.—A building for the College of Agriculture of Ohio State University has been completed during the present year at a cost of 70,000 dollars.—The will of the late Mr. Felix R. Bonnet, of Pittsburg, Pa., provides that, upon the death of his widow, 300,000 dollars shall go to the Western Pennsylvania University for the endowment of scholarships.—A donor, whose name is withheld, has subscribed 25,000 dollars for Barnard College in case the 100,000 dollars needed to liquidate the debt on the College are subscribed by October 3. 23,000 dollars had previously been subscribed.—Hobart College, Geneva, N.Y., has received 6000 dollars for a scholarship by the will of Mrs. Augusta M. Williams.—Mr. Philip D. Armour has given an additional endowment fund of 500,000 dollars to the Armour Institute of Technology, Chicago. He had previously given the Institute an endowment of 1,500,000 dollars.—Mr. Washington Duke has given 100,000 dollars to Trinity College, Durham, N.C., which makes the total amount of his gifts to the College 425,000 dollars.—Dr. D. K. Pearsons, who has assisted so many smaller colleges, has offered to give the Salt Lake College, of Salt Lake, Utah, 50,000 dollars, on condition that its officers raise 100,000 dollars more within a year.—Dr. George W. Hill has been appointed lecturer in celestial mechanics in Columbia University, Miss Catherine W. Bruce having given 5000 dollars for this purpose.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society,** May 26.—"On the Kathode Fall of Potential in Gases." By J. W. Capstick, M.A., D.Sc., Fellow of Trinity College, Cambridge. Communicated by Prof. J. J. Thomson, F.R.S.

Hittorf and Warburg have shown that when an electric current passes through a tube containing a gas at a pressure of a few millimetres, the fall of potential along the greater part of the tube varies with the pressure of the gas and the current strength, but in the immediate neighbourhood of the kathode there is a fall which is constant in amount provided the negative glow does not cover the whole electrode, or extend to the walls of the tube. It seems likely that this kathode fall will prove to be connected with other constants of the gas, and the aim of the present investigation was to find such a connection by measuring the kathode fall in a compound gas and its constituent elementary gases. The gases used were water vapour, ammonia, and nitric oxide and their constituents.

No difficulty was experienced in measuring the fall in the elementary gases, and the separate readings for any one gas showed good agreement. It proved, however, a very difficult matter to get a constant current to pass through the compound gases. Many months were spent in a fruitless attempt to find what conditions determine the constancy of the current, and since the kathode fall is not constant when the discharge is intermittent, very few measurements could be made on the compound gases.

The values in volts ultimately found for the kathode falls were as follows:—

| | |
|---|---|
| Hydrogen ... ... ... ... | 298 |
| Nitrogen ... ... ... ... | 232 |
| Oxygen ... ... ... ... | 369 |
| Water vapour ... ... ... ... | 469 |
| Ammonia ... ... ... ... | 582 |
| Nitric oxide ... ... ... ... | 373 |

Warburg had previously determined the fall in hydrogen and nitrogen. For the former, he found 300. For atmospheric nitrogen containing argon, he found 232. The present experiments were made on nitrogen prepared from ammonium nitrite, whence it appears that the presence of argon does not affect the kathode fall.

The value found for nitric oxide is of very doubtful validity. The appearance of the discharge showed that the gas is rapidly decomposed, and the fact that the kathode fall is nearly the same in nitric oxide, air and nitrogen with a trace of oxygen, points to the oxygen being the sole carrier of the electricity in each case.

If we leave nitric oxide out of account, it appears that the kathode fall is an additive quantity, and hence a property of the atoms rather than of the molecules.

Assuming that the conduction in gases is electrolytic, the analogy of the electrolysis of liquids suggests the possibility that the kathode fall is a measure of the heat of dissociation of the gas. If this be the case, the experiments might be taken to support J. J. Thomson's view that the carriers of the current are provided by the disintegration of the atoms into much smaller particles.

June 9.—"Experiments on Aneroid Barometers at Kew Observatory and their Discussion." By C. Chree, Sc.D., LL.D., F.R.S.

The paper deals with two species of data. The first consists of particulars derived from the records of Kew Observatory as to the errors in aneroid barometers subjected to the ordinary Kew test, which consists in lowering the pressure to which the aneroid is exposed inch by inch to the lowest point required, and raising the pressure in a corresponding way to its original value. Readings are taken at each inch of pressure during both the fall and the recovery, and a table of corrections is obtained by reference to a mercury gauge.

The second group of data are the results of special experiments made at Kew Observatory during the last three years.

The aneroid is an instrument exhibiting elastic after-effect. When pressure is lowered and then maintained constant, the reading continues to fall, and when pressure is restored to its original value, the aneroid reads at first lower than it did originally, but exhibits a tendency to recover. The most characteristic features were discussed thirty years ago by Dr. Balfour Stewart. They have also been the subject of a pamphlet by Mr. Edward Whymper, who gives the results of a number of interesting long period experiments.

The present paper treats of how the differences between the readings with pressure descending and ascending in a normal pressure cycle, such as the Kew test, varies throughout the range, and how the sum of these differences varies from one range to another. It investigates how the error, as pressure is reduced, varies with the rate of fall of pressure (when uniform), how the fall of reading at a low stationary pressure increases with the time, depends on the pressure, and varies with the rate of the previous fall of pressure, and how the recovery after a pressure cycle progresses with the time, and is modified by the nature of the previous pressure changes. The influence of subsidiary stoppages is investigated, and experiments are discussed showing the influence of temperature.

The opportunity is taken of considering the secular change of zero, and also changes in the elastic and the after-effect properties.

Algebraic and exponential formulæ are obtained for such phenomena as the variation of the differences of the descending and ascending readings throughout a pressure cycle, the dependence of the sum of such differences on the range, the fall of reading at the lowest pressure and the final recovery. A theory, to some extent empirical, is built up, leading to mathematical results, depending on only three arbitrary constants, for the behaviour of an aneroid in the ordinary Kew test over any range.

The large differences brought to light between different aneroids show that the means of markedly raising the average are already at the makers' disposal. The present inquiry shows clearly how the effects of tentative improvements may be ascertained.

**Physical Society**, June 24.—Mr. Walter Baily in the chair.—Prof. Carus-Wilson exhibited an apparatus to illustrate the action of two electric-motors coupled in such a way as to admit of their rotating at different speeds. The two shafts are placed in line, and each is fitted with a bevel-wheel, gearing into an intermediate wheel. The axis of the intermediate wheel is at right angles to the line of the motor-shafts, and is free to rotate in a plane at right angles to that line. The motors can be made to rotate at different speeds by altering the strength of the magnets of either or both. The motion of the intermediate wheel depends upon the difference of the two speeds, or upon their mean, according to their relative directions of rotation. A simple graphic construction enables the action to be predetermined for any given load on the intermediate wheel. Calling the two motors A and B, and the intermediate wheel C, lines can be drawn on a base of current to represent the speeds and the torques for each motor. If the motions of A and B are in the same direction, the load or torque is the same on each, and of similar sign. Hence, as the load on the wheel C is increased, the speeds of A and B tend to become equal (if A had been running faster than B); and for a certain load on C the speeds of A and B will be equal. If the load on C is further increased, B will run faster than A. Also, there will be a certain value for the load on C at which the motion of A will reverse. A further increase of the load on C will bring C to rest, A and B then rotating at equal speeds in opposite directions. When the load on C is nothing, let the motors rotate in opposite directions, A running faster than B. The motion of C now depends upon the difference of speeds of A and B. When a load is put on C, the motion of A is retarded, while that of B is assisted, hence B takes less current, and A takes more. The torques on the two motors, due to the load on C, are now of equal amount, but of opposite sign. As the load on C is increased, the speed of A is reduced, and that of B increased, until the two are equal, and C comes to rest. B is now acting as a generator, and sending current into A. If the load on C is simply that due to friction, the process cannot be carried further. But if the load on C is reversed, the speed of B becomes greater than that of A, and the motion of C is reversed. In the steering gear designed by the Union Electricitäts Gesellschaft, the intermediate wheel is made to actuate a rudder by differential action. The motion is reversed by making the speed of one motor greater or less than that of the other.—Mr. Quick then exhibited Weedon's apparatus for the measurement of the expansion of solids. This method is claimed to be independent of knowledge of optics on the part of the student. The expansion is read directly by means of a pair of micrometers. Precautions are taken to prevent errors due to radiation. Mr. Lehfeldt asked what precautions were taken to prevent the movement of the micrometer supports. Mr. Stansfield described a form of apparatus in use at Chelsea Polytechnic; it was a simple contrivance, in which changes of length were measured by a micrometer. Mr. Quick, replying, thought the instrument referred to by Mr. Stansfield pre-supposed a knowledge of optics.—Mr. Lehfeldt then read a paper by Dr. Donnan on the theory of the Hall effect in a binary electrolyte. In 1883 Roiti investigated the subject of a possible Hall effect in electrolytic solutions. He failed to obtain any positive result. Recently the question has been examined by Bagard, who noticed certain effects in aqueous solutions of zincic and cupric sulphates. Meanwhile, negative results have been observed by Florio. The author therefore discusses what effect might be expected by theory, on somewhat the same lines as those of Van Everdingen, jun., taking a more general case. So far as the present discussion goes, the author's theory is wholly in favour of the negative results of Roiti and Florio. It would appear that Bagard measured a phenomenon not contemplated by the theory as stated in the present treatment. Van Everdingen originally supported the positive results of Bagard; but his work, unfortunately, was rendered incorrect by the accidental omission of a numerical factor. He has since discovered the slip in his calculations, and now agrees with the author's conclusions.—The Chairman proposed votes of thanks to the authors, and the meeting adjourned until October, this being the last of the session.

**Linnean Society**, June 16.—Dr. A. Günther, F.R.S., President, in the chair.—Prof. J. B. Farmer and Mr. W. G. Freeman demonstrated the action of germinating peas, cress, and barley in causing the deoxidation of a watery solution of methylene blue to a colourless liquid on shaking up the latter with air, while on adding a drop of hydrogen peroxide the blue colour was restored. Green plants placed in the solution were found to act in a manner precisely similar to the seedlings, though the action may be modified by assimilation in sufficient light (see p. 185).—Mr. F. Enock exhibited and made remarks on the eggs of an hemipterous insect containing living parasites (*Prestwichia aquatica*), of whose life-history and habits he gave a detailed account (see p. 175).—Prof. Herdman, F.R S., exhibited some dissections, microscopic preparations, and drawings to illustrate the presence of modified pedal muscles in the oyster. It was shown that there was reason to believe that these muscles, the insertion of which into the shell had been noticed in the American oyster by Ryder and Jackson, were the representatives of the *protractor pedis* of other Pelecypoda. But, as the oyster has no foot in the adult, the muscles have been modified in their distribution and have acquired a new function.—Mr. Miller Christy read a paper entitled "Observations on the seasonal variations of elevation in a branch of a horse-chestnut tree."—A paper was read by Mr. G. W. Carpenter on *Pantopoda* collected by Mr. W. S. Bruce in Franz-Josef Land, in which he recorded the existence of eleven species, one of which he described as new. Of this, *Nymphon piliferum*, a detailed description was given, as of a new variety *Nymphon piliferum* var. *abbreviatum*.—A paper was read by Mr. J. E. Duerden on the morphological relationship of the Actiniaria and Madreporaria.—Dr. C. Forsyth-Major communicated a paper on some fossil Leporines, an abstract of which was given by Prof. Howes. The author's investigations are based on the description of Miocene fossils collected by himself in Sardinia, France and Italy, and on specimens preserved in the Museum of Natural History.

### PARIS.

**Academy of Sciences**, June 20.—Centenary of the foundation of the Conservatoire des Arts et Métiers, by M. Laussedat.—Actinometry in experimental balloons, by M. J. Violle.—On the study of the upper atmosphere, by M. L. Cailletet. An account of an experimental balloon ascent of June 8. The balloon was fitted with self-recording instruments, the lowest reading of the barometer, 118 m.m., corresponding to a maximum height of 13,700 metres.—On the boiling point of liquid ozone, by M. L. Troost. The temperature was determined by means of an iron-constantin couple, previously standardised in ice, boiling methyl chloride, nitrous oxide, ethylene, and oxygen. Several measurements were taken, the ozone always boiling steadily at − 119° C.—Preparation of crystallised calcium, by M. Henri Moissan. After a historical review of previous work on the subject, two methods are described which furnish calcium in white, hexagonal crystals (see p. 209).—On the classification of the Tunicates, by M. Edmond Perrier.—New gases in atmospheric air, by MM. Ramsay and Travers. An account of the discovery of neon and metargon.—On the Rubiaceæ of the Madagascar flora, by M. Emm. Drake del Castillo.—Comet discovered at the Observatory of Nice, by M. Giacobini.—Provisional elements of the Perrine comet (June 14, 1898).—Observations of the Coddington comet, Perrine comet (June 14), and the Giacobini comet, made at the Observatory of Toulouse with the Brunner equatorial, by M. F. Rossard.—Observations of the new Perrine comet (June 14) made at the Observatory of Paris, by MM. G. Bigourdan and G. Fayet.—Observations of the Coddington comet (June 11, 1898) made with the large equatorial at the Bordeaux Observatory, by M. L. Picart.—Application of interference fringes to the study of micrometers, by M. Maurice Hamy. A half-silvered lens of very slight curvature is fixed to the body of the micrometer, and a mirror to the moving portion of the instrument, the whole is illuminated with monochromatic light, and the method of fractional excess applied to the Newton's rings thus produced.—The equivalence group and kinematic bases, by M. Jules Andrade.—On the stability of equilibrium, by M. L. Lecornu.—On an apparatus called the anemotrope, by M. Maillet.—An optical method for measuring lengths up to several decimeters, by MM. A. Perot and Ch. Fabry.—Influence of tempering upon the electrical resistance of steel, by M. H. Le Chatelier. The resistance of steel is not influenced by tempering at temperatures below 710°, the temperature of recalescence. The resistance after tempering at 850°–1000° is about double that of the untempered metal. Some chrome and tungsten steels were also studied. At high temperatures chromium exaggerates the increase of resistance produced by tempering. Tungsten makes practically no difference.—On the rectification of alternating currents, by M. P. Janet.—On the paradoxical multiplication of a discharge derived from a condenser, by M. R. Swyngedauw.—Electrical resistance of the human body, by M. Dubois. The body acts as a condenser with liquid dielectric, of a capacity of about 0·165 microfarad. Under the action of continuous currents the resistance of the body may fall from 51,500 to 3030 ohms. But at any stage of this variable state, if the resistance be measured by a condenser method, with discharge through a ballistic galvanometer, the resistance is found to be invariable, about 400 ohms.—On the thioantimonites of the metals of the alkaline earths, by M. Pouget. The thioantimonites of barium, strontium, and calcium, of the form $R'_3.Sb_4S_9$, are described.—Pyridine bases, by M. Marcel Delépine. Thermochemical data are given for pyridine, piperidine, chloropiperidine, dipiperidine and δ-amidovaleraldehyde.—On some bases derived from piperidine, by M. G. André.—On some bromine derivatives of morphine, by M. H. Causse.—On some new aromatic diurethanes of piperazine, by MM. P. Cazeneuve and Moreau.—Action of chlorine upon ethylene chloride in presence of aluminium chloride. Chlorination of acetylene, by M. A. Mouneyrat. Ethylene chloride heated alone with $AlCl_3$ gives acetylene and hydrogen chloride. If chlorine is passed into the mixture, $CHCl_2.CHCl_2$ and $CH_2Cl—CCl_3$ can be isolated from the product. Chlorine and acetylene combine together quietly if all traces of oxygen are excluded.—Synthesis of symmetrical tetramethyl glutaric acid, by M. E. E. Blaise.—On a crystalline compound of acetylene with cuprous chloride, by M. Chavastelon.—On the cuticle of the palm of the hand and its evolution, by M. A. Cannieu.—Classification of the Molgulideæ, by M. 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